UNIVERSITI TEKNOLOGI MARA

DYNAMIC CHARACTERISTICS OF DAMAGE AND HEALTHY FOR FIBERGLASS REINFORCED EPOXY USING OPERATIONAL MODAL ANALYSIS

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Thesis submitted in fulfilment
of the requirements for the degree of
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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and the results of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non- academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Composite materials with nonlinear properties are proned to subsurface damages. Even though vibration response as damage detection method is widely used in engineering applications, its usage is to nonlinear and nonhomogenous properties especially in composite materials is still limited. This study attempts to apply vibration using Operational Modal Analysis (OMA) on fiberglass reinforced epoxy plate. OMA is used on undamaged fiber glass reinforced epoxy plate to extract the modal parameters and after which the procedure is extended to damage fiberglass reinforced epoxy plate. Both healthy and damaged composite material are tested for different boundary conditions i.e. free-free on 4 edges, 1 edge clamped, 2 edges clamped, 3 edges clamped and 4 edges clamped condition. Then result of frequency from OMA was compared analytically with finite element method. Nastran software is employed in this study. Based on the results, it shows that a high deviation between OMA and finite element method can be observed. Result of frequency from OMA was then compared with Experimental Modal Analysis (EMA) to validate the effectiveness of OMA method. It is shown that results obtained from OMA are equivalent with results obtained from EMA. Results of modal parameters obtained OMA was then compared between healthy and degrees of damaged (1st degree, 2nd degree and 3rd degree of damaged specimen 1 and specimen 2) specimen plates to detect damage using changes of modal parameters. Based from this comparison, it was found that frequency, mode shape and damping can be used to detect damage in fiberglass reinforced epoxy.

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TABLE OF CONTENTS

		Page
AUTHOR'S DECLARATION		ii
ABSTRACT		iii
ACKNOWLEDGEMENTS		iv
TABLES OF CONTENTS		v
LIST OF TABLES		viii
LIST OF FIGURES		xii
CHAPTER ONE: INTRODUCTION		
1.1	Background of the Study	1
1.2	Problem Statement	2
1.3	Objectives of the Study	3
1.4	Scopes of the Study	4
1.5	Significance of the Study	5
1.6	Organization of the Thesis	5
CHAPTER TWO: LITERATURE REVIEW		
2.1	Damage Detection Based Vibration	7
	2.1.1 Introduction of Damage Detection Based Vibration	7
	2.1.2 Development of Damage Detection Based Vibration	11
	2.1.3 Non-linear and Non-homogeneous Properties In Composite Materials	12
	2.1.4 Methods of Vibration Based Damage Detection	18
2.2	Operational Modal Analysis (OMA)	24
	2.2.1 Development of OMA	25
	2.2.2 OMA's Modal Parameter Extraction Methods	26
2.3	Finite Element Method (FEM)	29
	2.3.1 Introduction and Development of FEM	29